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H02G 3/22

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(58) Field of search
H2E
F2G

(54) Cable entry seal

(57) The invention relates to a cable bulkhead entry seal in which the seal is effected by the use of a heat shrinkable sleeve 28 which is recovered at one end around a washer to form a flange 32, or which is formed with a flange.

The heat shrinkable sleeve 28 is slid over a cable 29 and passed through a bulkhead sealing member 23. A bush 27 is slid over the cable and when tightened effects a seal through the medium or washer 26, flange 32 and washer 24 against a shoulder 33 on the bulkhead.

The heat shrinkable sleeve may then be shrunk onto the cable 29 and hot melt adhesive melted at 31 to fix the sleeve to the cable. In an alternative embodiment the sleeve extends on both sides of the bulkhead and is heat shrunk to the cable on each side.

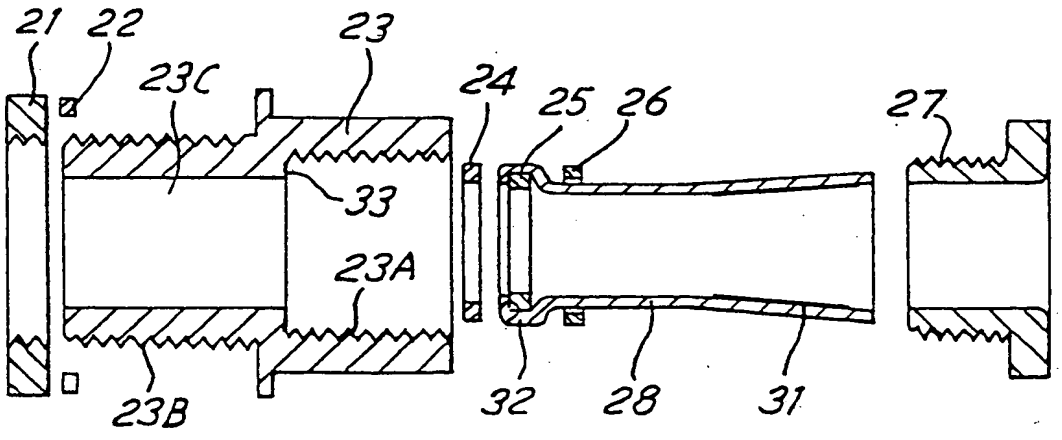

FIG. 3

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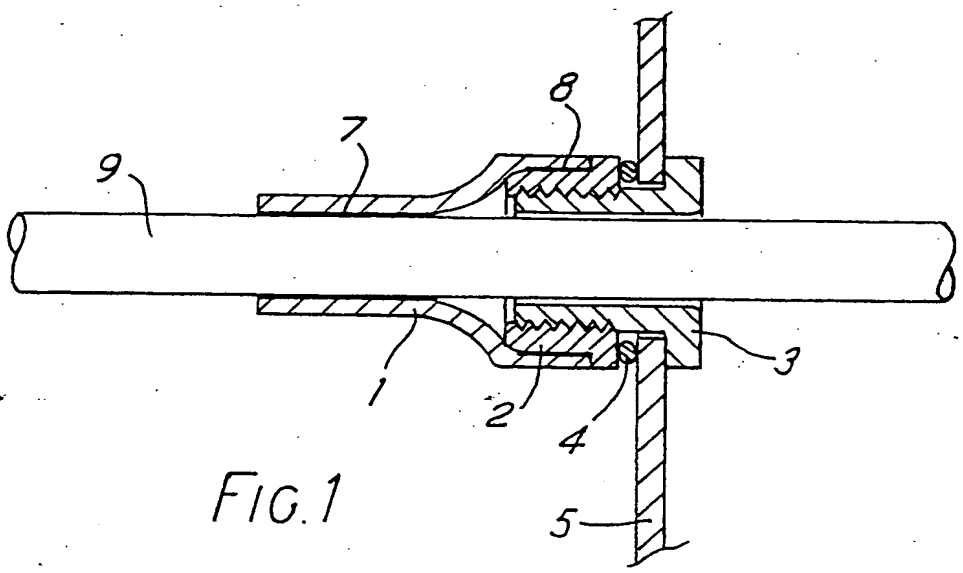

FIG. 1

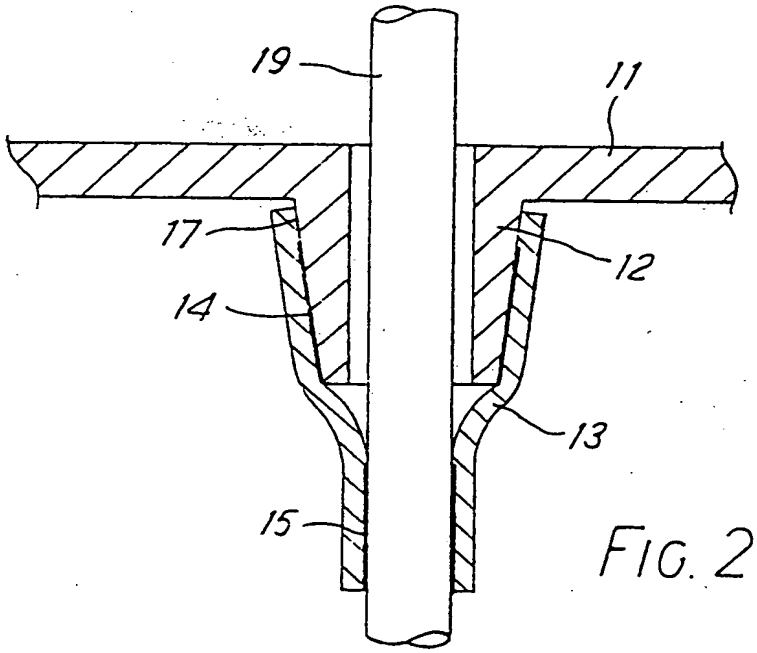

FIG. 2

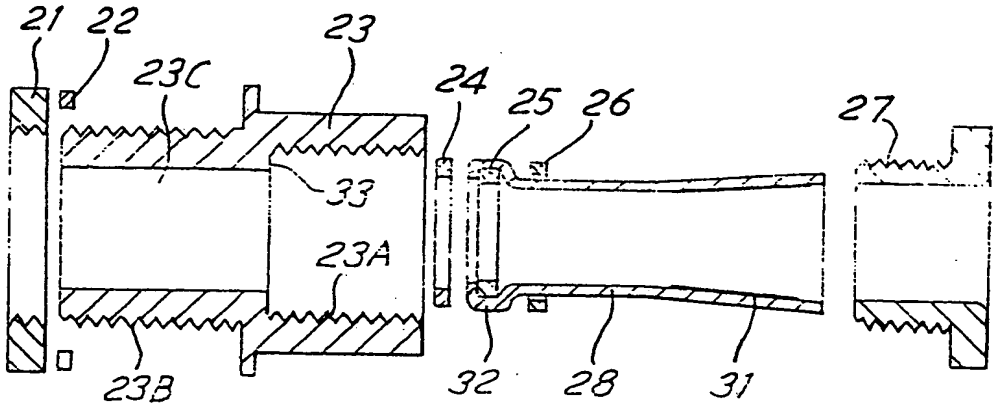
21
22
23C
23
24
25
26
27
33
23A
23B
32
28
31

FIG. 3

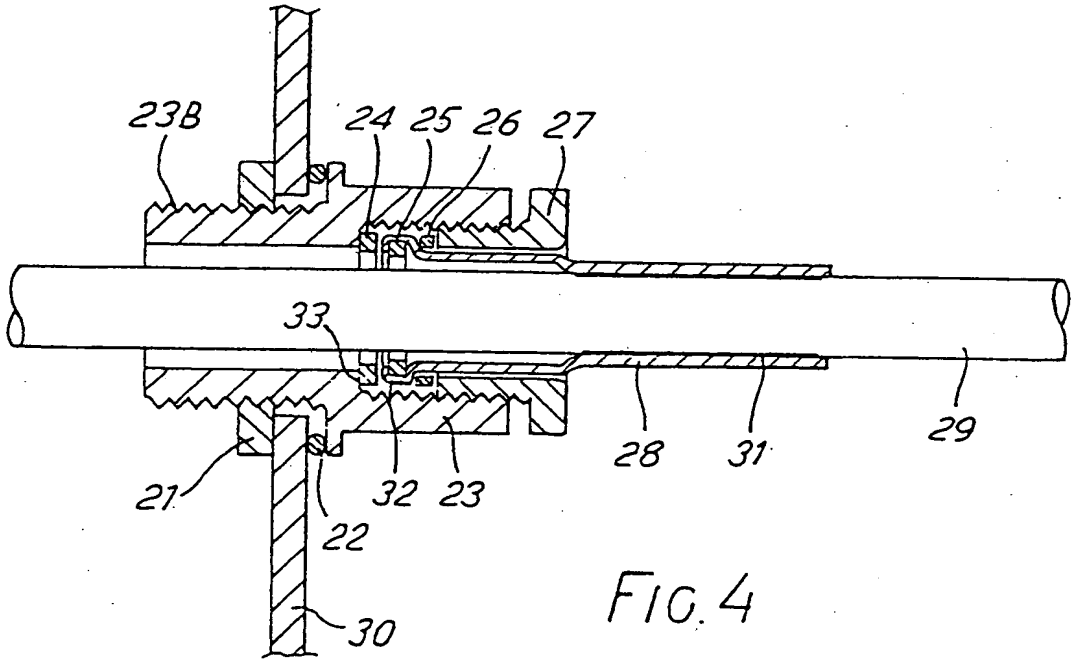
23B
24
25
26
27
33
28
31
29
21
32
23
22
30

FIG. 4

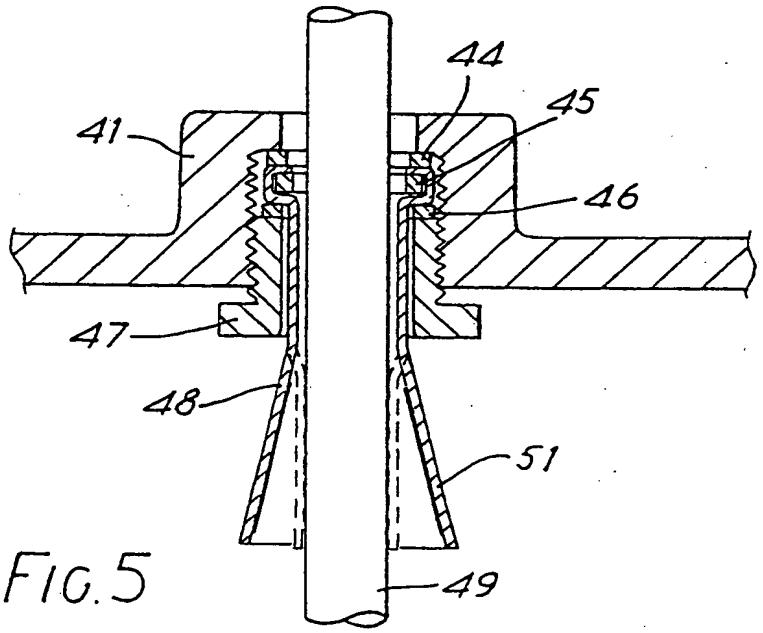

FIG. 5

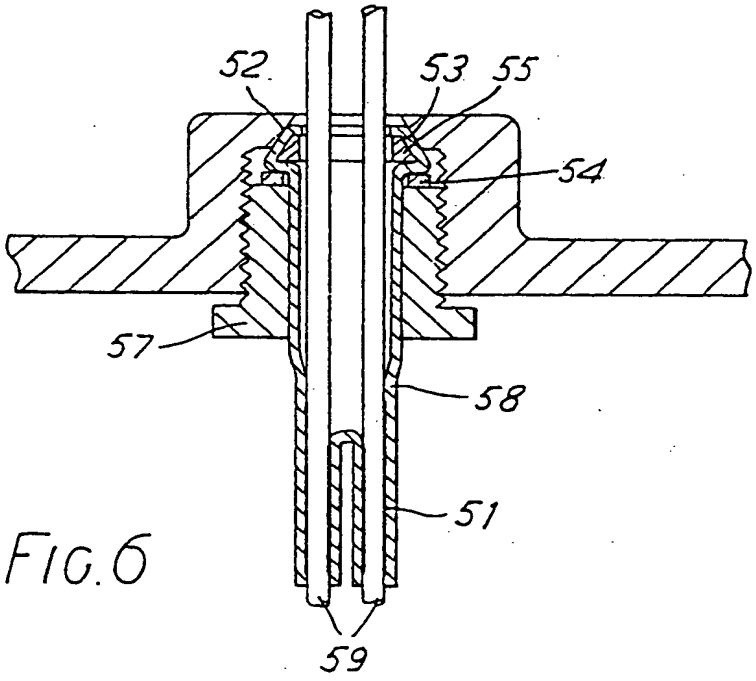

FIG. 6

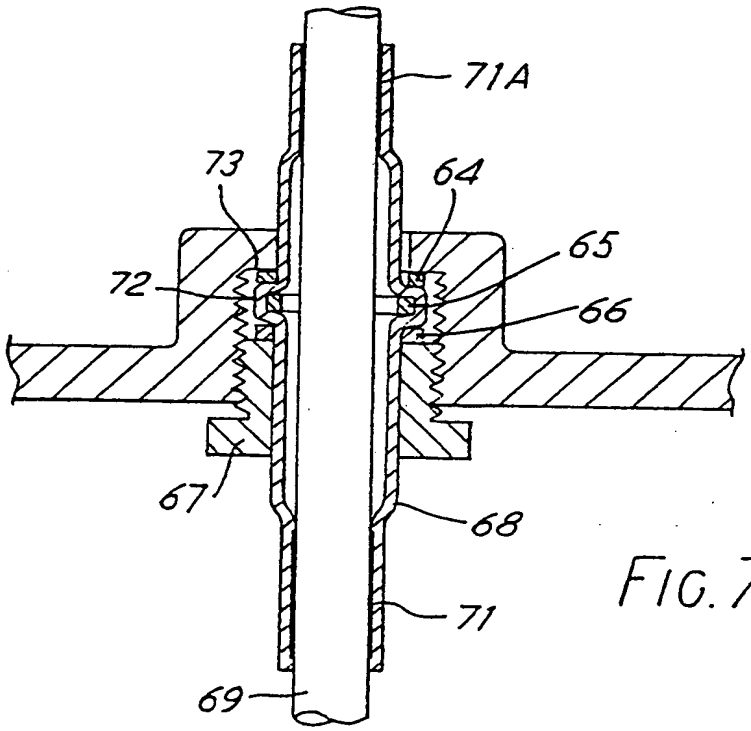

FIG. 7

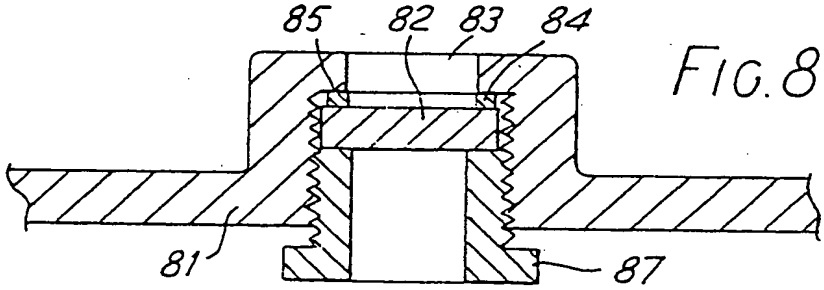

FIG. 8

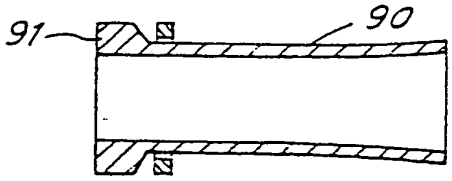

FIG. 9

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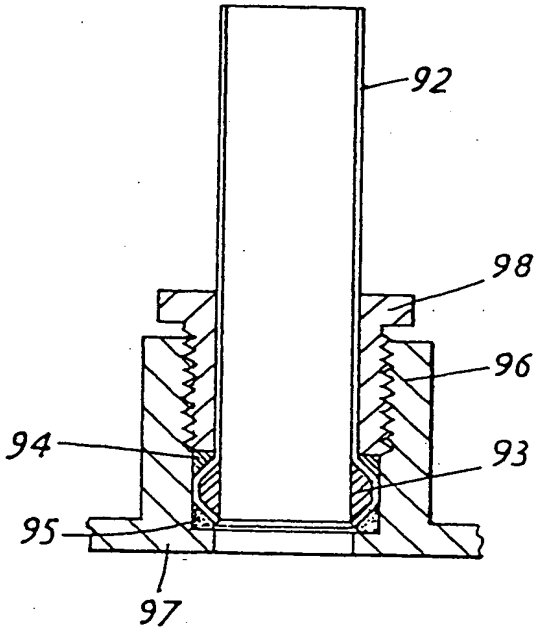

FIG. 10

SPECIFICATION

Cable entry seal

This invention relates to a cable entry seal system and particularly to a heat shrinkable sleeve used in such a system.

The invention has particular application to the sealing of cables or tubes of oval or circular shape into bulkheads using heat shrinkable or pre-stretched 'cold' recoverable parts.

Present methods of achieving such seals involve the creation of a rigid tubular support sleeve, projecting outward from the bulkhead wall.

These projections can form part of the wall or be threaded and sealed through the wall. The cable to be sealed is then passed through this tubular suppport sleeve and a heat shrinkable tube internally lined with a hot melt adhesive is positioned on the support sleeve overlapping the cable and recovered by applying heat. An object of the present invention is to provide a simple but effective method of producing a good seal using a novel form of sleeve made of heat shrinkable material. According to the present invention, there is a cable or tube entry seal system comprising a heat shrinkable sleeve adapted to be fitted over the cable or tube and a flange at one end of the sleeve formed by the heat sealing material itself either in the form of a moulded flange or in the form of heat shrinkable material encasing an internal collar or washer.

Preferably said cable or tube entry seal system is in combination with a bulkhead sealing member containing a threaded bore with a shoulder at its inner end and an externally threaded bush adapted to fit over the cable or tube and over the heat shrinkable sleeve and to abut the flange so that when the bush is tightened in the threaded bore the bush compresses the flange against the shoulder so as to form a seal.

Optionally there may be an O ring or flat seal between the flange and the shoulder, and there may also be a washer between the bush and the flange.

The heat shrinkable sleeve may pass through the bulkhead so that the heat shrinkable sleeve can be recovered and sealed onto the cable or tube on both sides of the bulkhead. From another aspect the invention relates to a bulkhead seal comprising a bulkhead cable support which has a bore through it, the bulkhead cable support being adapted to be held in a bore in the bulkhead, the bore in the cable support having a threaded enlarged portion to form a shoulder within the support, a flexible sleeve of heat shrinkable material adapted to fit over a cable, the flexible sleeve having at one end a flange formed by recovering the heat shrinkable material around a collar, and a bush with a threaded exterior adapted to pass over the heat shrinkable sleeve when it is in position on the cable and to abut the shoulder directly or indirectly, and, when screwed into the threaded portion of the cable support, to compress the flange against the shoulder in the cable support in the bulkhead.

From another aspect the invention lies in a bulkhead seal assembly comprising a sleeve adapted to fit over a cable; the sleeve being made of heat shrinkable material and having at an intermediate point along the sleeve a flang formed by recovering the sleeve over an internal collar also adapted to fit over the cable, the heat shrinkable sleeve and cable being adapted to fit into a bulkhead cable support which has an internal shoulder, a bush being provided which fits over the heat shrinkable sleeve and cable and screws into the bulkhead fitting so as to compress the flange against the shoulder.

In the accompanying drawings:—

Figure 1 is a section through a known bulkhead cable sealing assembly;

Figure 2 is a section through another known bulkhead cable assembly;

Figure 3 is an exploded sectional elevation of a bulkhead cable sealing system embodying the present invention showing the component parts unassembled;

Figure 4 is a sectional elevation of the same system when assembled;

Figures 5 and 6 are sectional elevations of additional embodiments of the invention;

Figure 7 is a sectional elevation of an embodiment of the invention which makes use of a heat shrinkable sleeve which extends along the cable and is sealed to it on both sides of the bulkhead;

Figure 8 is a sectional elevation of a plugged bulkhead entry;

Figure 9 is a longitudinal section through an alternative form of heat shrinkable sleeve embodying the invention; and

Figure 10 is a section through a modified bulkhead sealing assembly emboding the invention.

In Fig. 1 the known assembly is supplied with the heat shrinkable plastics part 1 already assembled on the rigid support bush 2 which is internally threaded and sealed to the bulkhead 5 by pressure exerted by the male threaded piece 3 on the O ring 4. The seal is maintained by the use of adhesive in the area 8 and a hot melting adhesive which adheres to the cable 9 in the area 7. Heat is applied in the area 7 shrinking (recovering) the plastic material which adheres to the cable so creating the seal. This type of entry seal is supplied assembled ready for fixing through a circular hole drilled in a bulkhead or closure wall.

In the known method illustrated in Fig. 2 the seal is generally moulded of heat resistant material and forms part of a cable closure. The closure wall 11 has a tubular projection 12 which is generally tapered for ease of mould-

ing. The cable 19 is placed in the aperture, the heat shrinkable sleeve 13 positioned on the projection 12 and heat applied recovering the sleeve 13 onto projection 12 and to cable 19. The internal coating of hot melt adhesive in sleeve 13 on application of heat, melts and bonds to cable and projection in areas 14 and 15 forming a seal. In practice the sleeve 13 is generally supplied with a non-adhesive gap around the inner circumference 17 to minimise the movement of the sleeve along the tapered projection while the adhesive is in a molten state.

The disadvantages experienced with the known type shown in Fig. 2 are as follows:—

1. The large area occupied by the assembly when a number of entries are required in close proximity.

2. The necessity for the support sleeve 12 and bulkhead 11 to be constructed of flame and heat resistant materials.

3. The length of the rigid projecting sleeve 12 combined with the heat shrinkable sleeve requires a long length of cable to effect the seal.

4. The difficulty in sealing cable entries, when there is no cable in the entry involving expensive moulding dies to provide "knock out" seals at the end of the projecting rigid sleeve 12.

5. The problem with entries in close proximity, involving the probability of damaging cable previously installed during installation.

The present invention overcomes the disabilities of the prior art.

The application of the invention to a bulkhead cable seal will now be described with reference to Figs. 3 and 4.

In Fig. 3 the components are shown unassembled. Components 21, 23, 25, 26 and 27 are constructed from rigid plastic or metal. Components 22 and 24 are made from elastomeric artificial rubber compound. Component 28 is a heat shrinkable plastic sleeve which is coated internally at 31 with a hot melt adhesive.

The bulkhead sealing member 23 has an internal threaded portion 23a and an external threaded portion 23b. The bore 23c extending through the bulkhead sealing member 23 has an enlarged section containing the threaded portion 23a and forming a shoulder 33.

The bulkhead selaing member is adapted to be attached to the bulkhead by means of a nut 21 and washer 22, the nut threading on the external thread 23b as illustrated in Fig. 4.

The heat shrinkable sleeve 28 embodying the invention has a flange formed by taking the sleeve itself at 32 around the collar 25. A rigid bush 27 co-operates with the bulkhead sealing member 23 to effect the cable bulkhead seal.

The complete assembly is shown in Fig. 4 in which it is seen that the sle ve 28 has been slid over a cable 29 and over a washer 24 already in place in the assembly so that as the cable is inserted into the bulkhead sealing member 23 the seal 24 abuts the shoulder 33 and the flange 32, together with collar 25 abuts the seal 24.

An additional washer 26 is then slid over the sleeve and the rigid bush 27 is tightened so as to compress the flange 32 between the seal 24 and washer 26 and against the shoulder 33. This effects an extremely good cable bulkhead seal. The heat shrunk sleeve is shrunk onto the cable 29 so that the hot melt adhesive 31 is melted by application of heat so as to fix the sleeve 28 to the cable 29.

In Fig. 5 an alternative form of bulkhead seal is shown in which the bulkhead 41 has the bulkhead sealing member formed in situ. This enables a simple bush 47 to be used which co-operates as before with the seal 44 and washer 46 to seal the flange formed round collar 45 by recovering the heat shrinkable material around it against the shoulder within the bulkhead sealing member 41. The heat shrinkable sleeve 48 again has hot melt adhesive 51 so that when heat is applied to the shrinkable sleeve to shrink it onto the cable 49 the adhesive melts and forms a firm bond and seal with the cable.

In Fig. 6 a multi-entry shrinkable glove is employed in place of the heat shrinkable sleeve 28 of Fig. 4 and this application can be applied to a bulkhead through which a number of cables extend at one location.

Another modification in Fig. 6 is the form of the bulkhead sealing member which has a tapered bore 52 co-operating with a specially shaped flange 53 formed by recovering the heat shrinkable material around a wedge section collar 55. The bush 57 and washer 54 are arranged to effect a seal by compressing the flange 53 against the tapered portion 52 of the bulkhead sealing member.

In Fig. 7 the form of the heat shrinkable sleeve has been modified. The sleeve 68 has two similar portions one on each side of the flange 72 which encases a collar 65. There are two layers of hot melt adhesive 71 and 71a, one on each end of the extended sleeve, and this enables the seal to be effected with the cable 69 on both sides of the bulkhead. The bush 67, when tightened, effects a seal by compressing washer 66 and 64 and thus sealing the flange 72 against a bulkhead shoulder 73. The heat shrinkable sleeve is recovered on both sides of the bulkhead and heat is applied to melt and hot melt adhesive at 71 and 71a to complete the bulkhead cable seal.

In Fig. 8 an arrangement is shown for sealing the bulkhead aperture when a cable is not required to pass through it. The bulkhead 81 has an aperture 83 extending through it and this is sealed by means of the bush 87 and a sealing disc 82 compressed against a seal 85.

In Fig. 9 an alternative form of heat shrinka-

ble sleeve 90 is shown. This heat shrinkable sleeve has a shoulder 91 formed at one end by moulding the sleeve rather than by encasing the collar within the sleeve as shown in the previous embodiments. The sleeve shown in Fig. 9 can be used in exactly the same way as described with reference to Figs. 3, 4 and 5 above.

In Fig. 10 is shown a modified form of the invention in which a heat shrinkable tube 92 is pre-shrunk over a collar 93 forming flaange 99 and is held in position by an externally threaded bush 98 screwed into a gland body 96. Between the end of bush 98 and flange 99 is washer 94. The collar 93 is chamfered to form two 45° surfaces and the washer 94 has one chamfered face, at 45°, and one face at 90° to the axis of the washer. Between the flange 99 and the shoulder 97 in the gland body 96 is a resilient 'O'-ring 95. The heat shrinkable sleeve 92 is shown before recovery onto cable or tube.

CLAIMS

1. A cable or tube entry seal system comprising a heat shrinkable sleeve adapted to be fitted over the cable or tube and a flange at one end of the sleeve formed by the heat sealing material itself either in the form of a moulded flange or in the form of heat shrinkable material encasing an internal collar or washer.

2. A cable or tube entry seal system according to Claim 1 in combination with a bulkhead sealing member containing a threaded bore with a shoulder at its inner end and a rigid bush adapted to fit over the cable or tube and over the heat shrinkable sleeve and to abut the flange so that when the bush is tightened in the threaded bore the bush compresses the flange against the shoulder so as to form a seal.

3. A cable entry seal according to Claim 2 and in which there is a sealing washer between the flange and the shoulder.

4. A cable entry seal according to Claim 2 or Claim 3 in which there is a washer between the bush and the flange.

5. A cable entry seal according to any of Claims 1 to 4 in which the heat shrinkable sleeve passes through the bulkhead so that the heat shrinkable sleeve can be recovered and sealed onto the cable or tube on both sides of the bulkhead.

6. A bulkhead seal comprising a bulkhead cable support which has a bore through it, the bulkhead cable support being adapted to be held in a bore in the bulkhead, the bore in the cable support having a threaded enlarged portion to form a shoulder within the sleeve, a flexible sleeve of heat shrinkable material adapted to fit over a cable, the flexible sleeve having at one end a flange formed by enclosing the collar in the heat shrinkable material, and a bush with a threaded exterior adapted to pass over the heat shrinkable sleeve when it is in position on the cable and to abut the shoulder directly or indirectly, and, when screwed into the threaded portion of the cable support, to compress the flange against the shoulder in the cable support in the bulkhead.

7. A bulkhead seal assembly comprising a sleeve adapted to fit over a cable; the sleeve being made of heat shrinkable material and having at an intermediate point along the sleeve a flange formed by shrinking the sleeve over an internal collar also adapted to fit over the cable, the heat shrinkable sleeve and cable being adapted to fit into a bulkhead cable support which has an internal shoulder, a bush being provided which fits over the heat shrinkable sleeve and cable and screws into the bulkhead fitting so as to compress the flange against the shoulder.

8. A cable entry seal substantially as hereinbefore particularly described and illustrated in Figs. 3 and 4 of the accompanying drawings.

9. A cable entry seal substantially as hereinbefore particularly described and illustrated in Figs. 5 and 6 of the accompanying drawings.

10. A cable entry seal substantially as hereinbefore particularly described and as illustrated in Fig. 7 of the accompanying drawings.

11. A cable entry seal substantially as hereinbefore particularly described and as illustrated in Fig. 10 incorporating a formed flange over an inner collar having bearing faces of up to 90° to the collar axis.

12. A cable entry seal substantially as hereinbefore particularly described incorporating a formed flange over an inner collar or a moulded flange which incorporates an O ring or flat sealing washer abuting onto a shoulder incorporated in the assembly.

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